Just Pimping the CV? The Feasibility of Ready-to-use Bibliometric Indicators to Enrich Curriculum Vitae

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Abstract
This poster investigates if ready-to-use bibliometric indicators can be used by individual scholars to enrich their curriculum vitae. Selected indicators were tested in four different fields and across 5 different academic seniorities. The results show performance in bibliometric evaluation is highly individual and using indicators as "benchmarks" unwise. Further the simple calculation of cites per publication per years-since-first-publication is a more informative indicator than the ready-to-use ones and can also be used to estimate if it is at all worth the scholar's time to apply indicators to their CV.
Keywords: bibliometrics, ready-to-use indicators, nano-level evaluation, individual metrics, impact
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1 Introduction

As bibliometric techniques have become readily available and easier to apply at the nano-level they have become increasingly used as both self-evaluation and third party evaluations (Wouters et al 2013). The ACUMEN[1] collaboration is investigating the challenges this increased use has on the correct application of bibliometric indicators on a small amount of data. The term "application" encompasses the correct interpretation of these statistics on the individual level, the use of indicators as "benchmarks" of scholarly performance, and the conclusions that can be drawn. These challenges are discussed in many bibliometric studies, eg., (Glänzel & Wouters 2013, Bach, 2011, Costas et al 2011, Costas et al 2009, Sandström 2009), but at the current time it is still unclear which indicators are appropriate for which scholars and in which fields. This study examines this gap in knowledge.

We apply ready-to-use indicators, available through Publish or Perish, and investigate if scholars can potentially use these indicators themselves to increase the value of, i.e. enrich, the publication information on their CVs. CVs were selected because in an evaluation situation they often represent the scholar in the form of a document. Aspects to be considered in the analyses of each of the indicators chosen for the study are:

1. Is the indicator more appropriate in some disciplines than others?
2. Is the indicator more appropriate for some seniority than others?
3. Is the indicator gender appropriate?
4. Does the indicator produce information that is redundant if used in combination with other indicators?
5. Does indicator produce useful information that scholars can use to enrich their CV?
6. Does the indicator have a positive or negative effect on the profile of the scholar?

[1] For more information about ACUMEN (Academic Careers Understood through Measurements and Norms) see: http://research-acumen.eu

2 Method

2.1 Data Collection

Publication data and ready-to-use bibliometric indicators were obtained for European scholars in the fields of Astronomy, Environmental studies, Philosophy and Public Health. Scholars in these fields were identified in a questionnaire study of scholarly web-presence undertaken by the University of Wolverhampton in December 2011[2].

Of the 2154 scholars who responded, 793 provided a link to an online CV. We collected publication, citation data and indicators in Google Scholar via Publish or Perish[3] from June 13th to July 20th 2013, resulting in a sample of 750 researchers with active online CVs. All types of print publications were included to account for the different publishing traditions of the fields. Publications were verified using the publication lists on the CVs or via a publication list linked to the CV.

2.2 Dataset

The dataset consists of a sample of 750 researchers: 584 men and 165 (22%) women, Table 1.

	nPhD	nPost Doc	nAssis Prof	nAssoc Prof	nProf	Total
Astronomy	15	48	26	67	37	193
Gender M/F	*12:3*	*37:11*	*20:6*	*58:9*	*35:2*	*162:31*
Environment	3	17	39	85	51	195
Gender M/F	*3:0*	*11:6*	*30:9*	*72:13*	*44:7*	*160:35*
Philosophy	9	22	45	75	78	229
Gender M/F	*6:3*	*20:2*	*37:8*	*57:18*	*63:15*	*183:46*
Public Health	9	14	31	50	29	133
Gender M/F	*2:7*	*7:7*	*18:13*	*34:16*	*19:10*	*79:53*
Total	36	101	140	277	195	750
Discipline M/F	*23:13*	*75:26*	*105:36*	*221:56*	*161:34*	*585:165*

Table 1: Distribution of seniorities and gender across the disciplines in the sample

2.3 Indicator identification

The ready-to-use indicators tested in this study are the cumulative indicators of individual performance from Publish or Perish[4]. They were chosen based on selections criteria presented in our previous review of 114 bibliometric indicators used in individual evaluation (Wildgaard et al, submitted).They are: Total number of papers (P), years since first publication (PY), total number of citations (C), cites per paper (CPP) and the average number of citations per paper normalized for years since first publication ($CPAY$). Indicators often defined as indicators of "quality": h-index (h), g-index (g), e-index (e) and age-weighted index[5] (AW). With this information the scholar can easily calculate the m-quotient (m) and the mg-quotient[6] (mg). These indicators do not adjust for the amount of authors-per-paper or add age-weighting parameters to each cited article.

[2] http://cybermetrics.wlv.ac.uk/survey-acumen.html

[3] http://www.harzing.com/pop.htm. Publish or Perish is a software program that retrieves and analyzes academic citations obtained from Google Scholar or Microsoft Academic Search.

[4] For more information about the indicators see: http://www.harzing.com/pophelp/metrics.htm

[5] AW index: AW is the square root of the number of citations to a given body of work divided by the total number of papers, it approximates the h-index if the average citation rate remains more or less constant over the years.

[6] Mg-index: mg is a variation of the m-quotient. The m-quotient is h adjusted for the number of years since first publication; mg is the g-index adjusted for the number of years since first publication

3 Main results and discussion

Women make up 22% of the overall sample reflecting the European ratio of men to women in science, 3:1[7]. In the junior categories, PhD students, post docs and assistant professors, the ratio men to women is 2:1, while in the senior categories, associate professor and professor, the ratio is 4:1. This reflects the 2012 SHE figures of gender in research, confirming that our sample patterns the share of women employed in academia across Europe where gender imbalance increases with seniority[8].

However, the size and content of the seniority categories were not homogenous. The spread of publication and citation data within categories and across fields was highly skewed and it was difficult to estimate effects of indicators and detect homogeneity, which is important if we wish to establish performance benchmarks. We used quartiles to illustrate the spread of the data and the median or second quartile as the best estimate of average performance within group. In all seniorities there were outliers that pulled the average performance up or down. Therefore the relative interquartile range (RIQR) was calculated. Even when outliers were removed, the variation in the number of publications a scholar produces, within each seniority, in Astronomy, Environmental Studies and Philosophy was still very large, but in Public Health there was less variation.To understand if we need to recommend gender specific indicators, we studied the career trajectory of scholars in our sample. Our hypothesis was a longer publication history in the junior seniorities could be an indirect indicator of possible female discrimination or other disruption in career promotion. PY was calculated and analyzed in panel box plots by gender and seniority to identify differences in length of publication history between male and female scientists. According to our data, advancement from PhD to associate professor for both genders was based on a 9 to 11 yearlong publication history. Professors had PY 3 to 6 years longer than associate professors in Astronomy and Public Health and additional 9 to 11 years in Philosophy and Environmental Studies. Women do not appear to need a higher number of publication years to advance. We compared the performance of female scholars to male scholars within seniority using the other indicators in this study. The performance of each indicator was highly individual and no gender-specific patterns were identified.

We took Astronomy as a case study. Scholars were ranked per seniority in descending order for each indicator, *P, PY, C, CPAY, h, g, e, AW, m, mg*. Each ranking was copied to a table depicting the performance of all scholars, within seniority, across all indicators. The tables were divided into lower and upper quartiles. Each scholar's placement in the rankings of each indicator was mapped manually and categorized as high (3rd quartile), middle (second quartile) or low (1st quartile). This resulted in the identification of two groups of indicators. The first group showed predictive relations: *h, g, e, AW, m, mg* where a high, middle or low score on one indicator predicted a high, middle or low score on another. The e, AW, m supplemented h while mg supplemented g. The top 25%, middle 50% or bottom 25% scholars remained the same but ranked in a different order.

The second indicator group was "unpredictive" indicators: *PY, P, C, CPP, CPAY*. For example, a low P did not result in a high C - likewise a high PY did not predict a high P. The threshold where the ratio C to P resulted in a high CPP was highly individual. No individual or seniority patterns were found across this sub-group of indicators, and ranking resulted in different scholars appearing in the top, middle or bottom quartiles. No difference was observed between $CPAY$ and m, resulting in redundant information.

We suspected a ratio relationship between PY, P and C that controlled level of performance across ALL indicators. The ratio "years since first publication to amount of publications" was calculated for each scholar in Astronomy, then the ratio "years since first publication to total citations". This is the math

[7] Directorate-General for Research and Innovation, Unit B6 (2012) SHE Figures 2012: Gender in Research and Innovation. European Commission: Brussels. Retrieved from: http://ec.europa.eu/research/science-society/document_library/pdf_06/she-figures-2012_en.pdf

[8] SHE figures 2012.

behind the *CPAY* indicator, but the ratio is more informative than the single number *CPAY* produces, eg. Scholar A averages 2 papers per year over his career and receives 28 citations per year=1 (year): 2(papers):28 (citations) = 1:2:28 (CPAY=28). By comparing the scholar's rank to their ratio we found the predictive indicators favour scholars with the ratio short "career:many papers:high citation count" over scholars with different "career:paper:citation" ratios. To investigate if it is the amount of citations per paper per year that dictate how useful the indicators will be to the scholar, we divided the amount of citations per year by the amount of publications per year for all the scholars identified in the top, middle and low quartile, eg. Scholar A ratio score 1:2:28, citation score per publication per year = 28/2=14. We compared this ratio score to their rank position and found the ratios within seniorities fit for the whole group, which in our dataset is a proxy for the disciplinary level, Table 2.

	PhD student	Post Doc	Assistant Prof	Associate Prof	Professor
Ranked in top 25% across all indicators	Not observed	⩽18 citations per publication per year	⩽19 citations per publication per year	⩽27 citations per publication per year	⩽28 citations per publication per year
Ranked in middle 50%	Not observed	>3 but <8 citations per publication per year	>7 but <18 citations per publication per year	>10 but <15 citations per publication per year	>15 but <27 citations per publication per year
Ranked in bottom 25%	⩽2 citations per publication per year	⩽3 citations per publication per year	⩽8 citations per publication per year	⩽7 citations per publication per year	⩽9 citations per publication per year

Table 2: Astronomy: Grouped ratios citations to papers to year

4 Conclusion

Publication and citation data is highly skewed, and using simple average based indicators, as an indicator of performance misrepresents the individual. The heterogeneity of the data makes comparisons to peers unwise and disciplinary benchmarks uninformative, however the low variance in the amount of publications between scholars in the same seniority in Public Health shows potential for the development of useful expected performance benchmarks. Gender specific indicators were not necessary in this study; we are aware of the many other variables in academic careers that can affect the career paths of female scholars. The *h, g, e, AW, m* or *mg* indices supplemented each other but exhibited a predictive relationship. There was information redundancy between the indicators *CPAY* and *m*.

The simple calculation of cites per publication per years-since-first-publication is more informative of a researcher's publication activity and citation impact than the ready-to-use metrics. Further, it has the potential to be used to estimate if it is at all necessary for scholars to apply indicators to their CV. This is interesting for evaluation as instead of adding value to the information on CVs, unnecessary use of indicators can detract from the value of a researcher's academic profile.

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